and 4. Smoothed records of hourly relative humidity, taken from a carefully checked and regulated hair hygrograph, are included.

The records obtained during these two wind storms as well as the records of many lighter and less destructive desert winds, indicate quite definitely that "wind burning" of citrus trees occurs only when the relative humidity is unusually low. Heavy winds without excessively low relative humidity have caused no burning whatever, while relatively light winds with low humidity have never failed to cause some damage to foliage. While the dividing point on the relative humidity scale between burning and no burning varies slightly with different wind velocities and different conditions of the trees, all the records obtained in this study indicate that foliage burn is suffered only when the relative humidity falls to 10 per cent or lower. So far as could be determined, all the foliage burn which occurred during December, 1927, was caused by the first desert wind, on the 3d and 4th. The second wind, on the 17th and 18th, blew off many leaves which had been damaged in the earlier storm, but apparently caused no new burning. The second wind blew considerably more fruit from the trees than the first one, but this was owing to the fact that the loss of foliage during the first wind left the fruit on the inside of the trees without protection.

A careful inspection of the two orange groves in which the wind-break studies were carried on was made immediately after the desert winds of December, 1927. At the check station the average loss of foliage caused by "wind burning" was 30 per cent over the entire orchard. In the orchard behind the windbreak there were very slight indications of burning in the tops of the trees for a distance of 72 feet therefrom, probably caused by the wind which came through the lower part of the break. Soil moisture condition, due to the proximity of the wind-break trees, also probably was a factor. From 72 feet to 288 feet from the break there was no burning whatever. From 288 feet to 500 feet the amount of burn slowly increased from zero to about 2 per cent. From 500 feet to the western boundary of the orchard, 784 feet from the break, the damage increased more rapidly, the heaviest burn appearing in the last 250 feet. In the last row the foliage burn was estimated to be approximately 10 per cent.

In the orchard protected by the windbreak no fruit was blow off the trees for a distance of 288 feet. From this point to the 500-foot line fruits on the ground averaged four to the tree. From 500 feet to the western border of the orchard, 784 feet from the windbreak, the number of fruits per tree on the ground increased rapidly. A count of oranges under 10 trees in the last row showed an average of 30 per tree.

The number of oranges per tree on the ground in the check orchard varied from 98 to 452, with an average for all parts of the grove of 163.

The relative humidity was always somewhat higher behind the windbreak during relatively light desert winds, but there was little difference between the two stations during the heaviest winds.

These studies indicate that a windbreak such as the one for the orchard in which the records were obtained, affords practically complete protection from desert winds, both as to loss of fruit and damage to foliage, up to a distance of about 500 feet, and partial protection up to at least 800 feet from the break. Data on wind damage show the necessity for an adequate system of windbreaks throughout the sections visited most frequently by desert winds. The disastrous effects of desert winds in 1924 and 1927 resulted in the planting of many miles of new windbreaks in portions of Orange County, but lack of severe winds in recent years has resulted in many of them being removed. Large windbreak trees compete for food and moisture with citrus trees in adjoining rows, and cause some reduction in the crop of fruit. Also the planting of windbreaks throughout a large area increases the frost hazard to some extent. However, the protection from desert wind damage far outweight either of these factors in the districts most subject to wind damage.

Many different types of windbreaks have been devised in addition to the familiar lines of growing trees. Views of artificial windbreaks erected in an orange grove near El Modena, Calif., are shown in Figure 6. They are placed in every fourth tree row north and south, or about 96 feet apart, extend to a height of about 23 feet and are anchored firmly to heavy stakes driven into the ground. Their cost, when constructed with secondhand lumber, was slightly more than 75 cents per running foot.

Studies to determine the effectiveness of these windbreaks were carried on during the winter of 1930–31. Unfortunately the wind direction at the chosen location was subject to change from north to east, or vice versa, during the progress of desert winds, so that the wind direction was sometimes parallel to the windbreaks. When the wind was in the east its velocity midway between two breaks was reduced by approximately 50 per cent, but when the wind direction changed to north, the velocity was sometimes stronger between the breaks than at the check station. The windbreak structures withstood velocities as high as 20 miles per hour without any indication of weakness.

Acknowledgment is due Mr. Harold A. Rathbone, junior meteorologist in the Weather Bureau, for installing and caring for meteorological equipment at the two wind stations, and for keeping records of wind damage. The writer is grateful for his assistance.

SNOW COVER IN SOUTHERN CANADA AS RELATED TO TEMPERATURES IN THE NORTH ATLANTIC STATES AND THE LAKE REGION

By R. H. Weightman

[Weather Bureau, Washington, D. C., September 25, 1931]

It has been stated frequently, and apparently with reason, that a snow cover of more than normal amount over central and eastern Canada in the late winter should retard the usual rapid rise of spring temperatures in the Lake Region and the north Atlantic States, with resultant low temperatures over those regions during the spring months, particularly the month of April. Similarly snow cover greater than normal over northwestern Canada and northeastern Alaska in the late winter should be followed by low spring temperatures in the Plains States and Upper Mississippi Valley.

Amount of snowfall for the month is available at a number of stations in Canada and northeastern Alaska but the amount of snowfall during one month is not the information that will have the most direct bearing on temperatures in our northern border States in the following month. The feature that should have the most important effect is the depth of snow at the end of the month, as for example March as affecting temperatures in April. This is true because the greater the depth of snow, the longer will the snow cover last, other conditions being equal. The snowfall might have been considerable during the month of March and yet, due to melting and evaporation all of it and some that was already on the ground at the beginning of the month might not be available at the end of the month to exercise any effect on subsequent temperatures. It is found that for stations in southern Canada, a number of which have depth of snow at the end of the month available beginning with 1916, even with a considerable fall of snow during the month of March, the depth at the end of March was less than at the end of February. For example, the depth of snow at Ottawa at the end of February, 1916, was 41.5 inches, the fall of snow during the month of March, 1916, was 23.1 inches, while at the end of March, 1916, the total depth was only 7 inches. No data for depth of snow at end of the month are available for Alaskan stations.

Our study is therefore confined to the years 1916 to 1928, a period of 13 years in all. It was decided to enter on working charts the amount of snow on the ground at the end of March for Canada and on the same base map to draw lines in the United States showing departures from normal temperatures as taken from the Monthly Weather Review. It may be questioned whether the actual depth of snow would be as good an index as either departure from normal or percentage of normal. There are, however, obvious objections to one of these methods alone so that it was decided to use a combination of them, whereby the depth of snow will be indicated and, in addition, information made available to show when the snow cover was greater or less than normal. Table 1 shows depth of snow on the ground at the end of March for 30 stations, all of which, with the exception of Dawson, are in southern Canada. The location of these stations is shown on chart 1. The figures in italics are interpolated values. The average depth at the end of March appears at the foot of each column. Charts 2 to 14 show by black lines the depth of snow on the ground at the end of March in southern Canada for the 13-year period, 1916–1928, while red hatchings show areas where snow cover was greater than normal. Departures of temperatures from normal in the United States for April, as taken from the Monthly Weather Review, are shown by red lines.

NORTH ATLANTIC STATES

It was decided to first compare outstanding cold and warm months in the North Atlantic States district No. 1 (see Chart No. 1), followed later with similar comparisons for the Lake region, district No. 3, and then take a few cases of the extensive cold and warm months for northern States from the eastern slope of the Rocky Mountains to New England. Districts 1, 3, 4, 5, and 7.

Let us first examine Aprils with temperatures 1° or more below normal in the North Atlantic States as represented by the means of 10 stations well distributed in New England, central and eastern Pennsylvania and eastern New York. They were 1917 (−1.5°), 1920 (−1.7°), 1926 (−3.6°), and 1928 (−1.4°). We may summarize briefly the snow cover conditions in southern Canada at the end of March for these years, as follows:

1917.—Above normal over the middle and lower St. Lawrence Valley with an area extending westward to the east of Lake Superior and to the north of Lake Huron; also, over portions of Saskatchewan, and northern Manitoba. Elsewhere, so far as observations are available, snow cover was below normal. This condition was followed by April temperatures, 1.5° below normal in the North Atlantic States.

1920.—Above normal over Manitoba, central and southern Saskatchewan, and central Alberta, but considerably below normal over eastern Canada as a whole. The April temperature departure in the North Atlantic States was −1.7°.

1926.—Above normal in the St. Lawrence Valley, southeastern Ontario, and Canadian Maritime Provinces but below normal over central and western Canada. In the North Atlantic States, April temperatures averaged 3.6° below normal.

1928.—This year was very similar as regards snow cover to that of 1926, but with a temperature deficit in April of 1.4° in the North Atlantic States.

Of the four cold Aprils, three, namely, 1917, 1926, and 1928, were preceded by a snow cover greater than normal in the St. Lawrence Valley, while the fourth case, 1920, was just the opposite, as snow cover less than normal existed in that region at the end of March. The year 1923 showed the greatest and most extensive snow cover at the end of March of any year of the series for which data are available. The region with above normal depth extended from the Canadian Maritime Provinces westward over Quebec, Ontario, central and southern Manitoba and Saskatchewan. Temperatures in the North Atlantic States were, however, only 0.4° below the normal. The next heaviest month was March, 1916, with snow cover above normal, extending over all of Ontario and northern Manitoba, being followed by April temperature departures in the North Atlantic States of only −0.2°.

The other months of March had snow cover either very close to or below the normal over the St. Lawrence Valley region, in practically all cases being followed by near or above normal April temperatures in the North Atlantic States, except in 1920, when with considerably below normal snow cover in the St. Lawrence Valley and westward over Ontario, the April temperature averaged 1.7° below normal.

We have thus far examined years in which the April temperatures in the North Atlantic States were below normal. Let us now give attention to years in which temperatures in that region were 1°, or more, above normal, as follows: 1921 (+5.6°), 1922 (+1.8°), and 1925 (+2.2°).

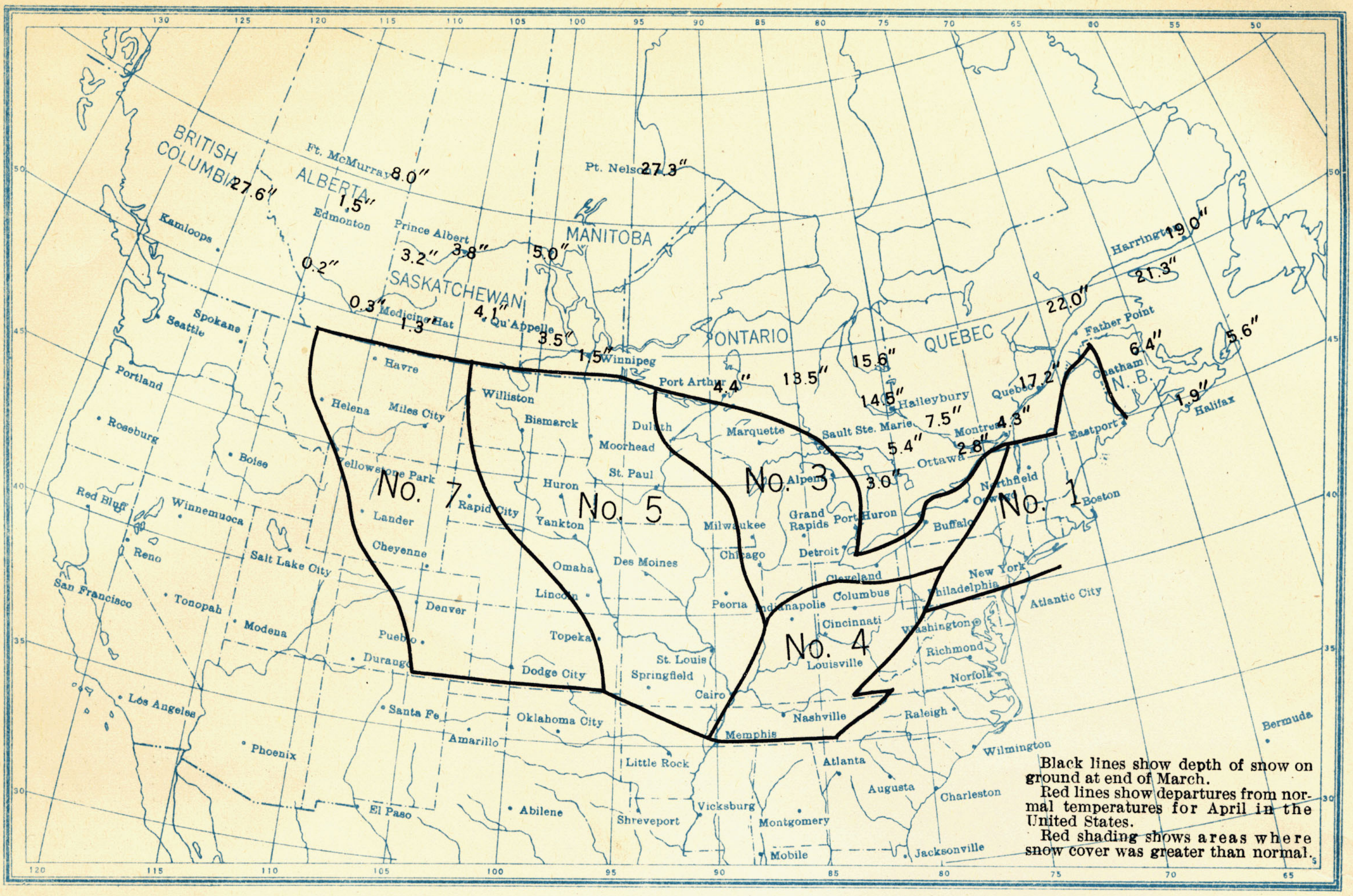
1921.—Snow cover was less than normal at the end of March over central and eastern Canada, being much below in the St. Lawrence Valley and in Ontario from Port Arthur eastward to Cochrane and Haileybury, the only area of above normal cover was over northern Saskatchewan and northern Manitoba. These conditions were followed by April temperatures in the North Atlantic States, 5.6° above normal.

1922.—Snow cover was below normal in the St. Lawrence Valley, western Ontario, and southeastern Manitoba, being followed by an April temperature departure in the North Atlantic States of +1.8.

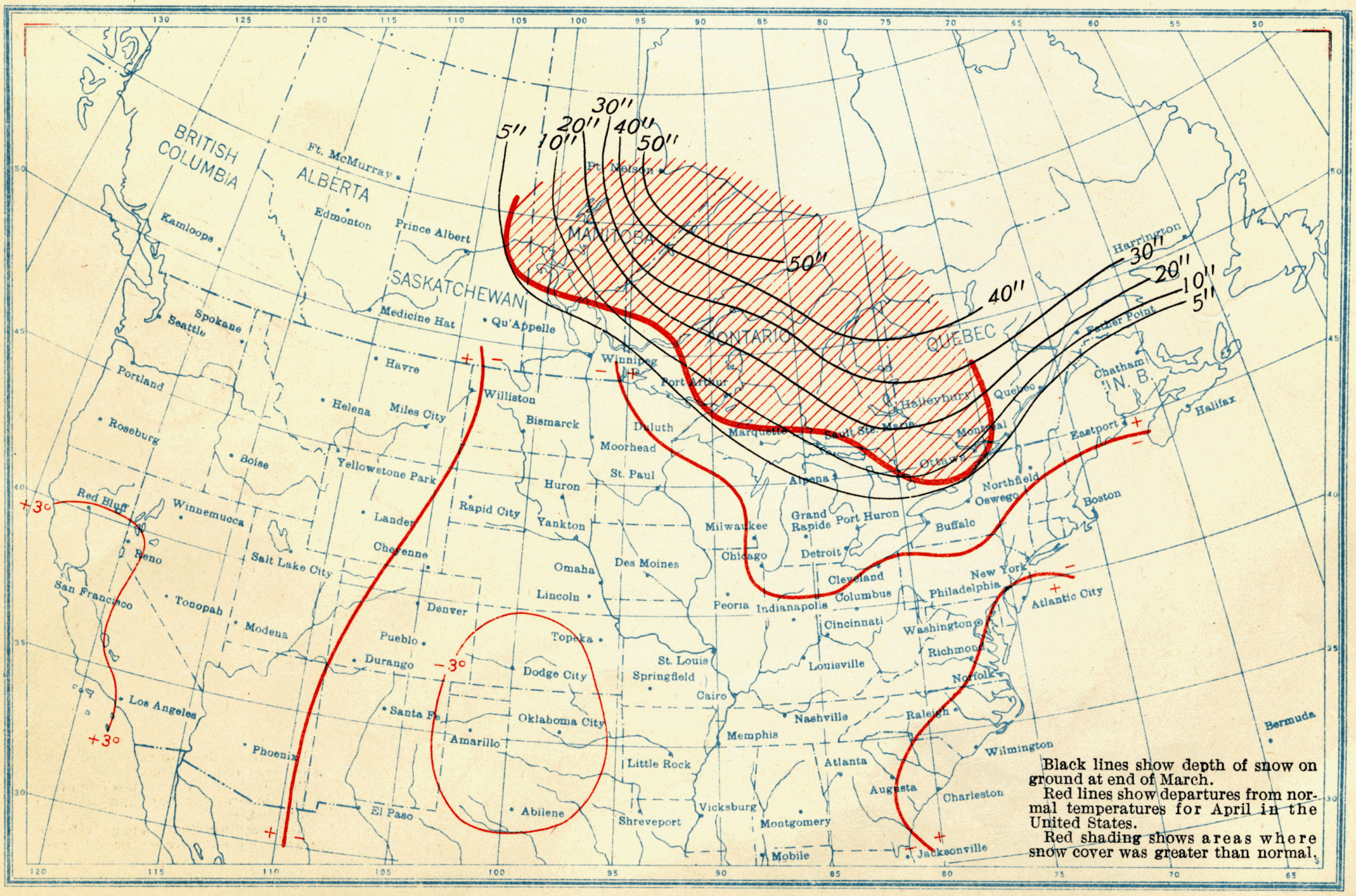
1925.—Snow cover was below normal in the St. Lawrence Valley except at Quebec, in eastern Ontario, except at Cochrane, and in Saskatchewan and Manitoba, being followed in April by temperatures 2.2° above normal in the North Atlantic States.

In all three cases of warm Aprils in the North Atlantic States, snowfall was below normal in the St. Lawrence Valley.

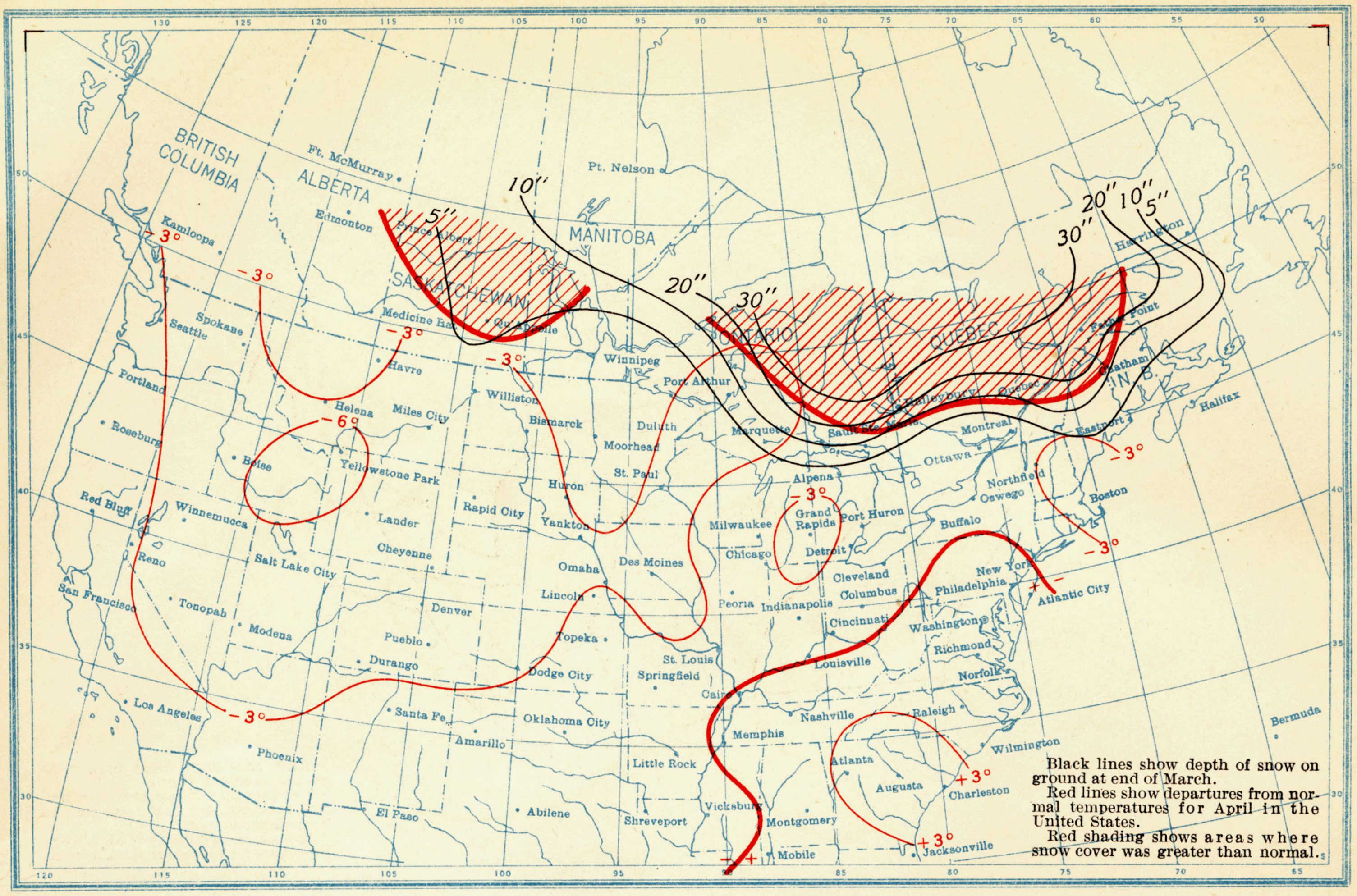
Average Snowfall at End of March



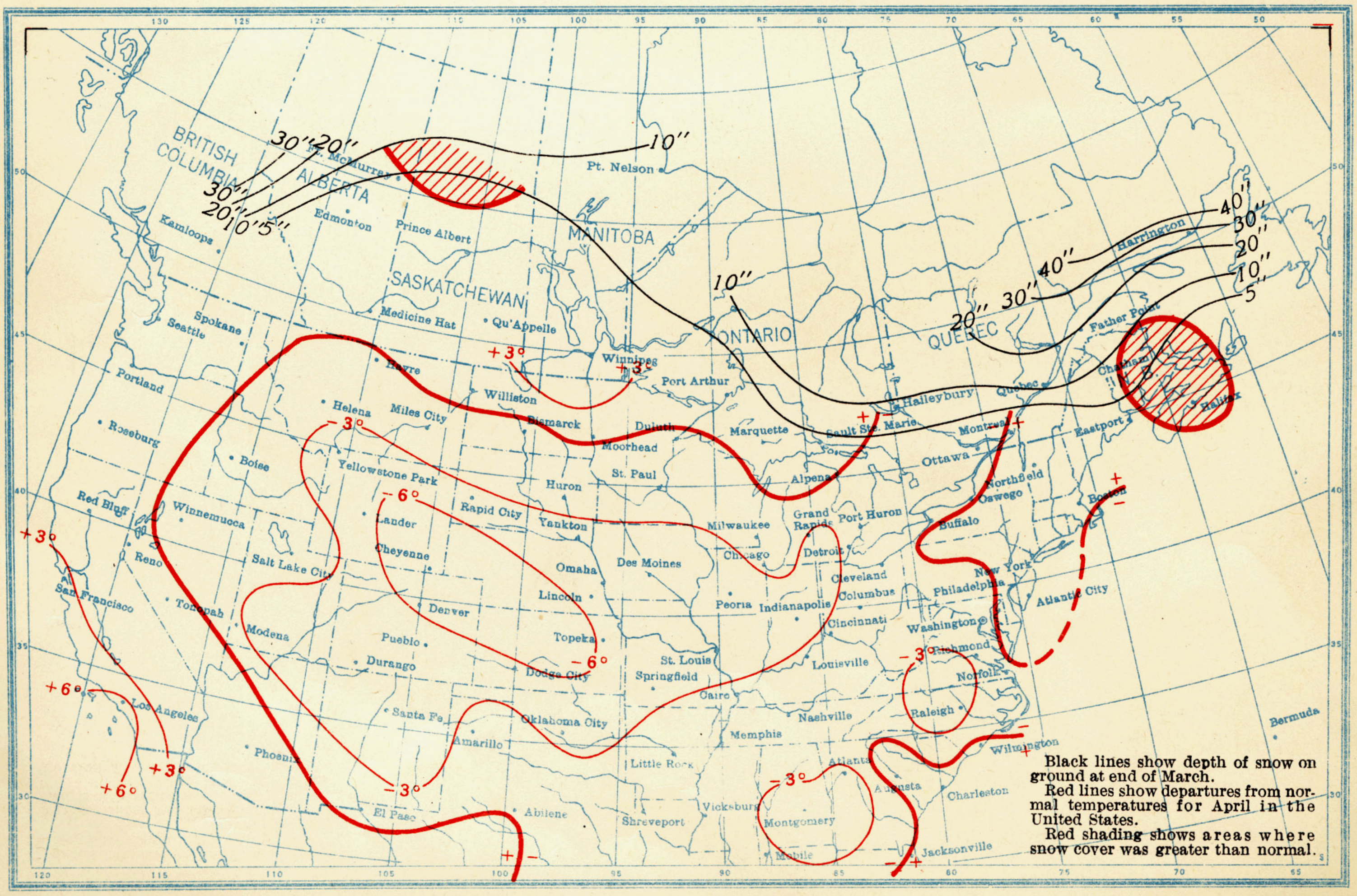
Snowfall Over Southern Canada at End of March and Temperature Departures in the United States for April, 1916



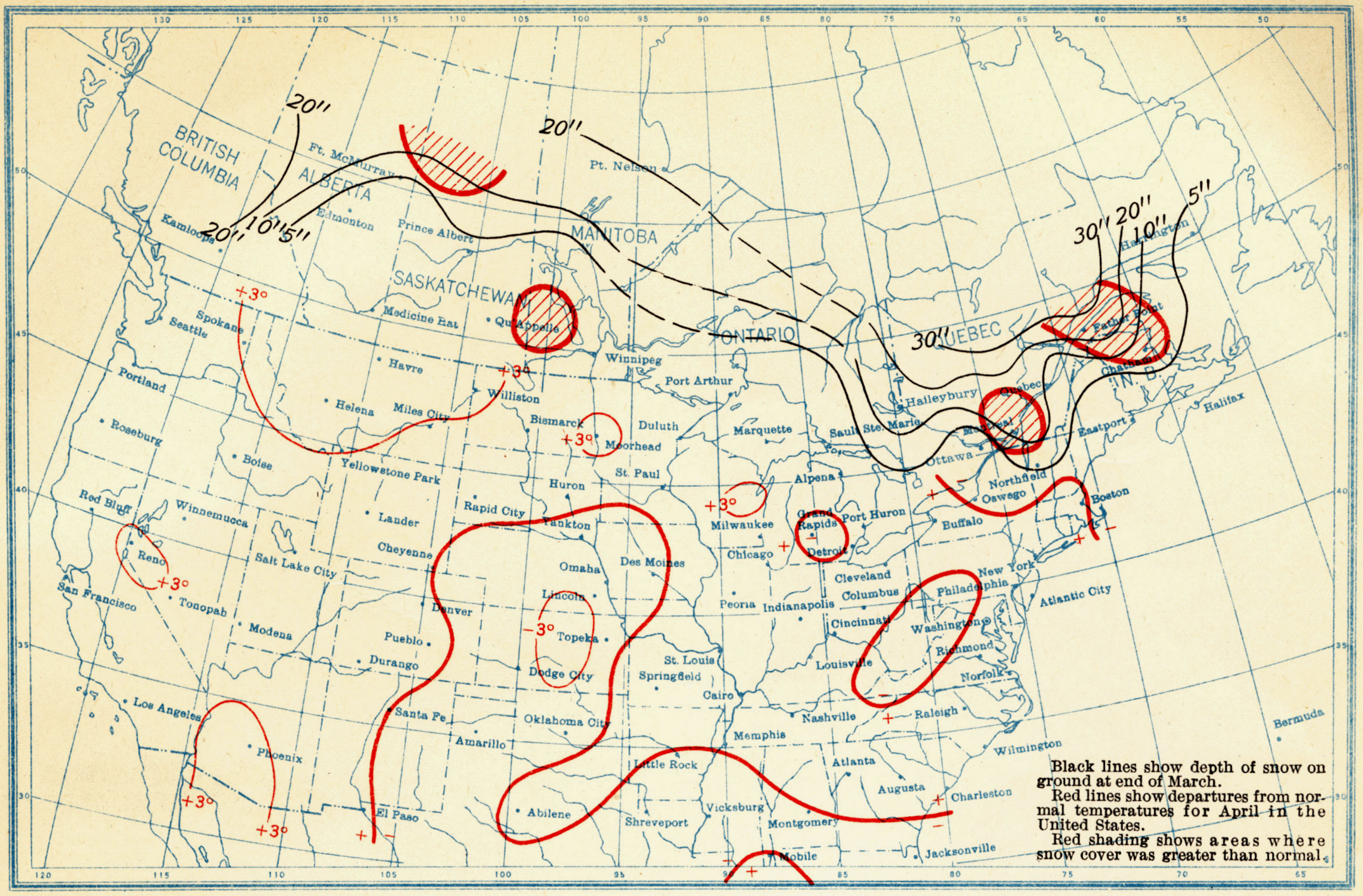
Snowfall Over Southern Canada at End of March and Temperature Departures in the United States for April, 1917



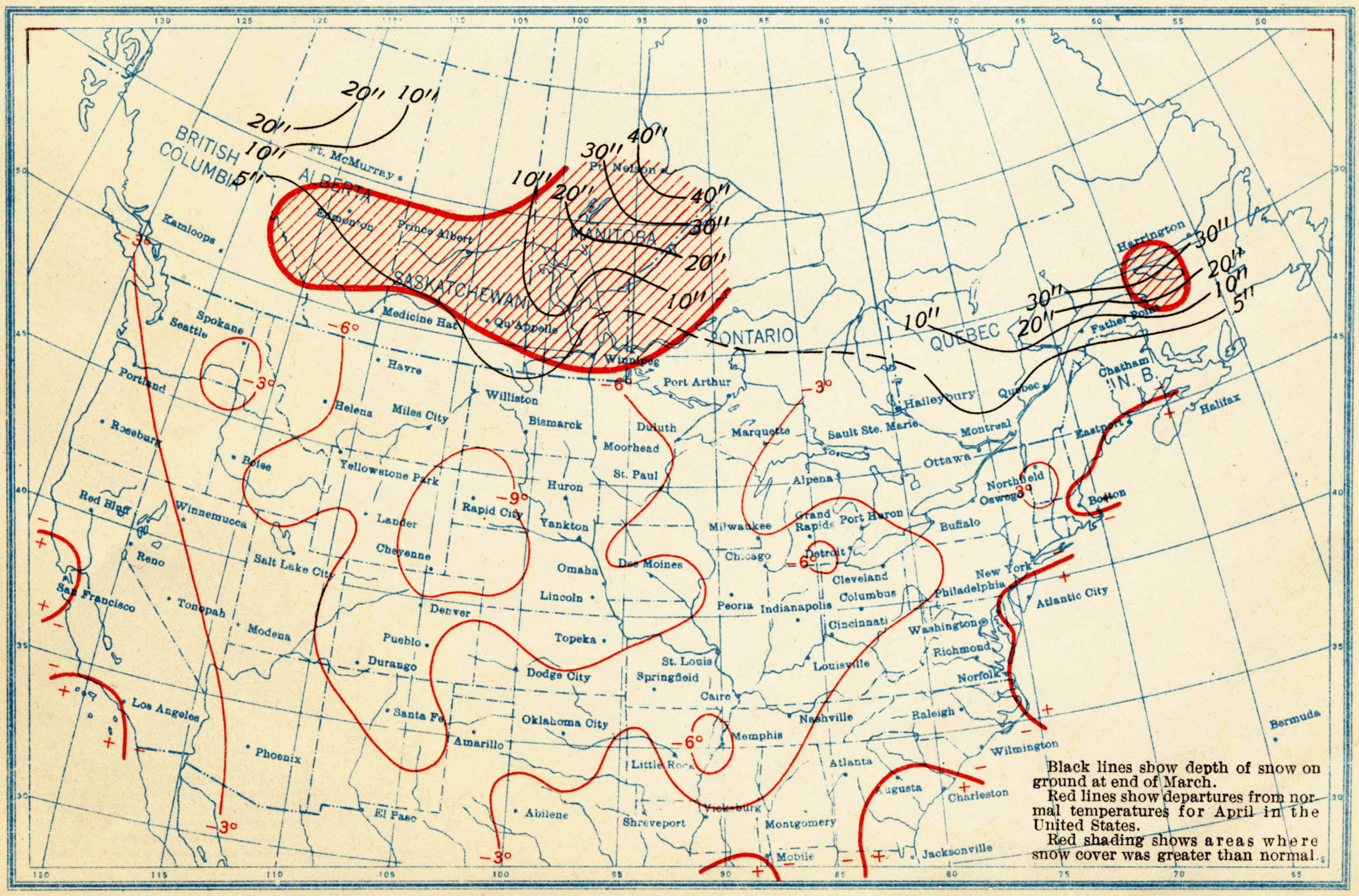
Snowfall Over Southern Canada at End of March and Temperature Departures in the United States for April, 1918



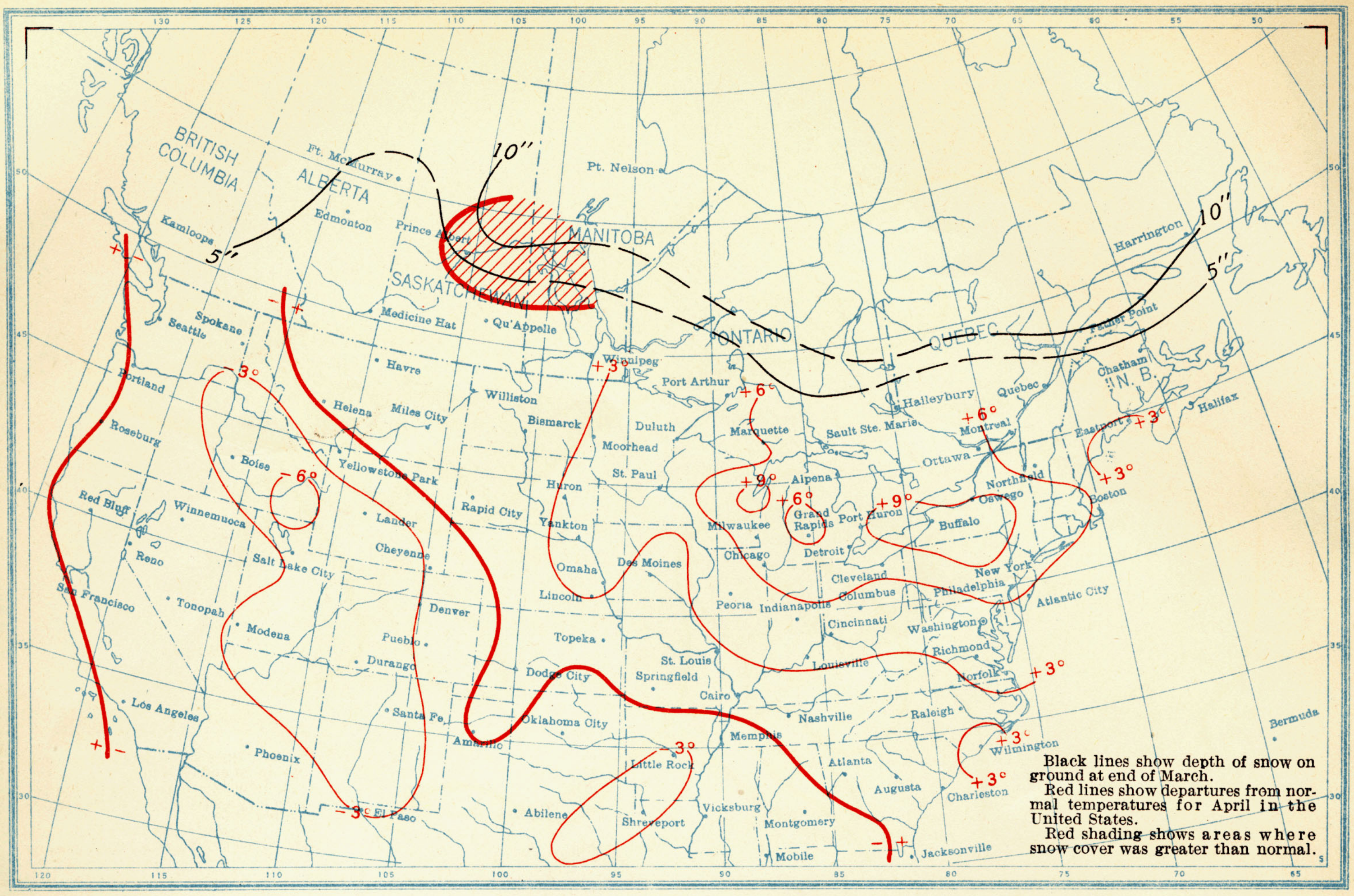
Snowfall Over Southern Canada at End of March and Temperature Departures in the United States for April, 1919



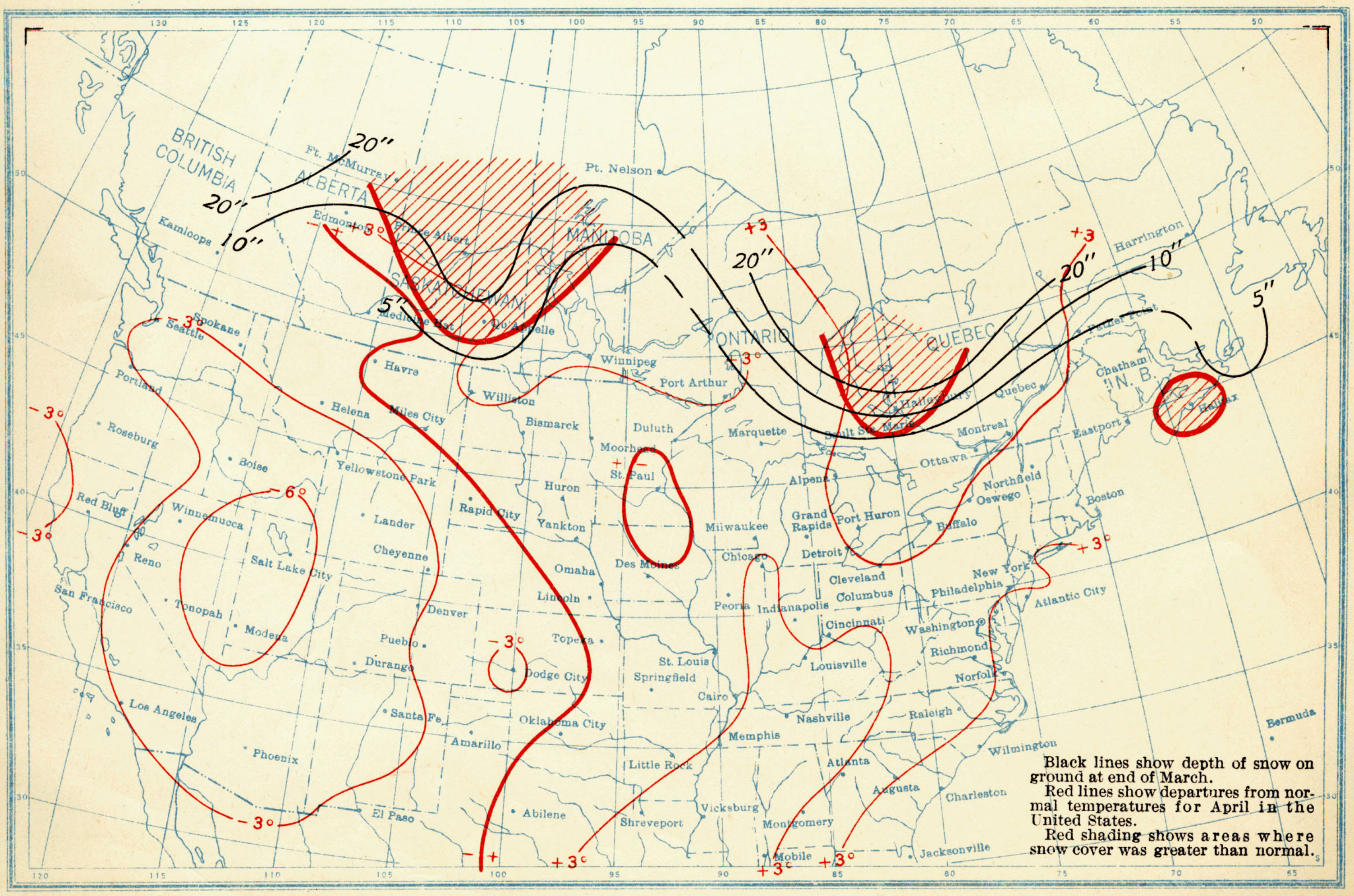
Snowfall Over Southern Canada at End of March and Temperature Departures in the United States for April, 1920



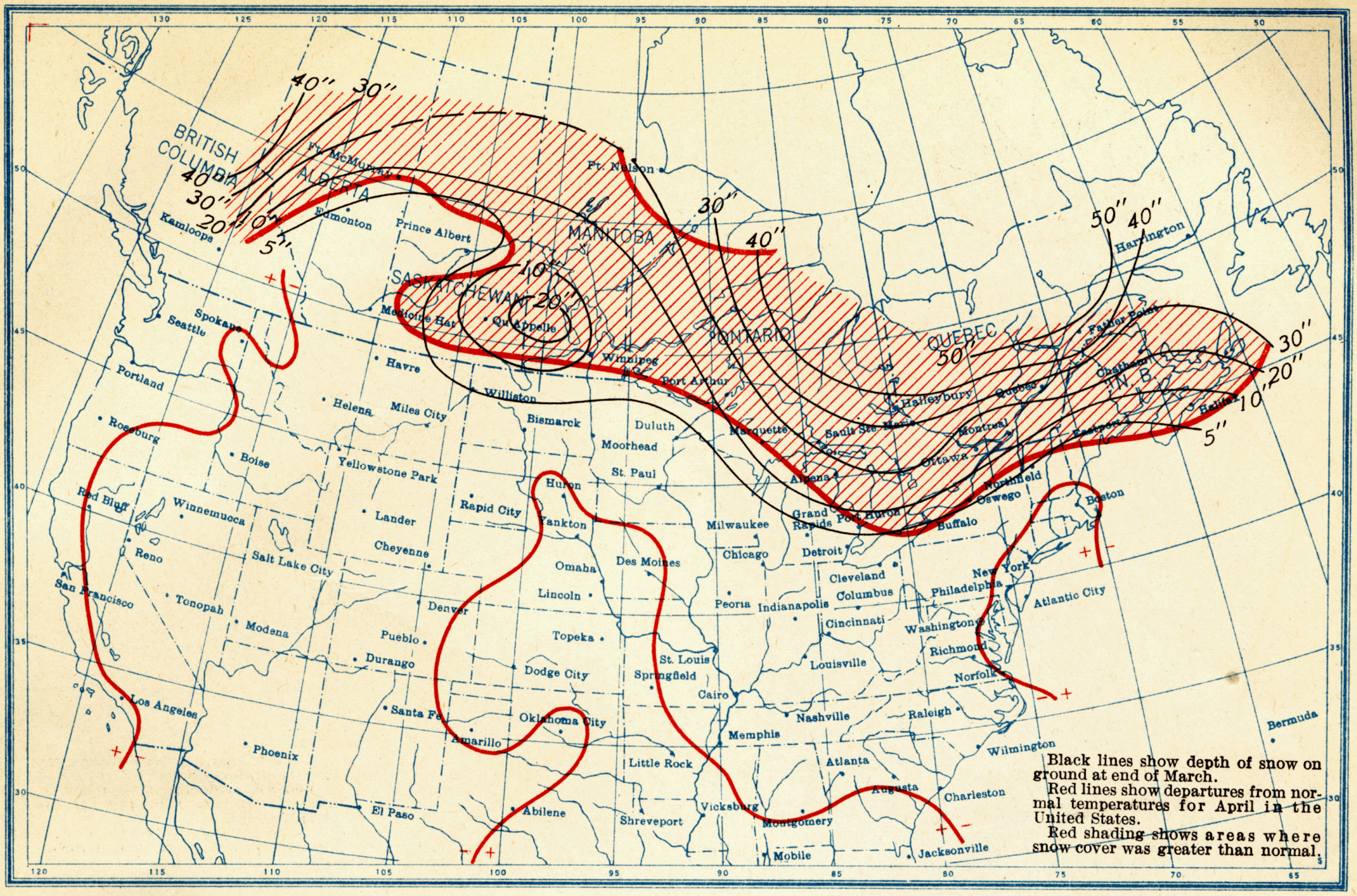
Snowfall Over Southern Canada at End of March and Temperature Departures in the United States for April, 1921



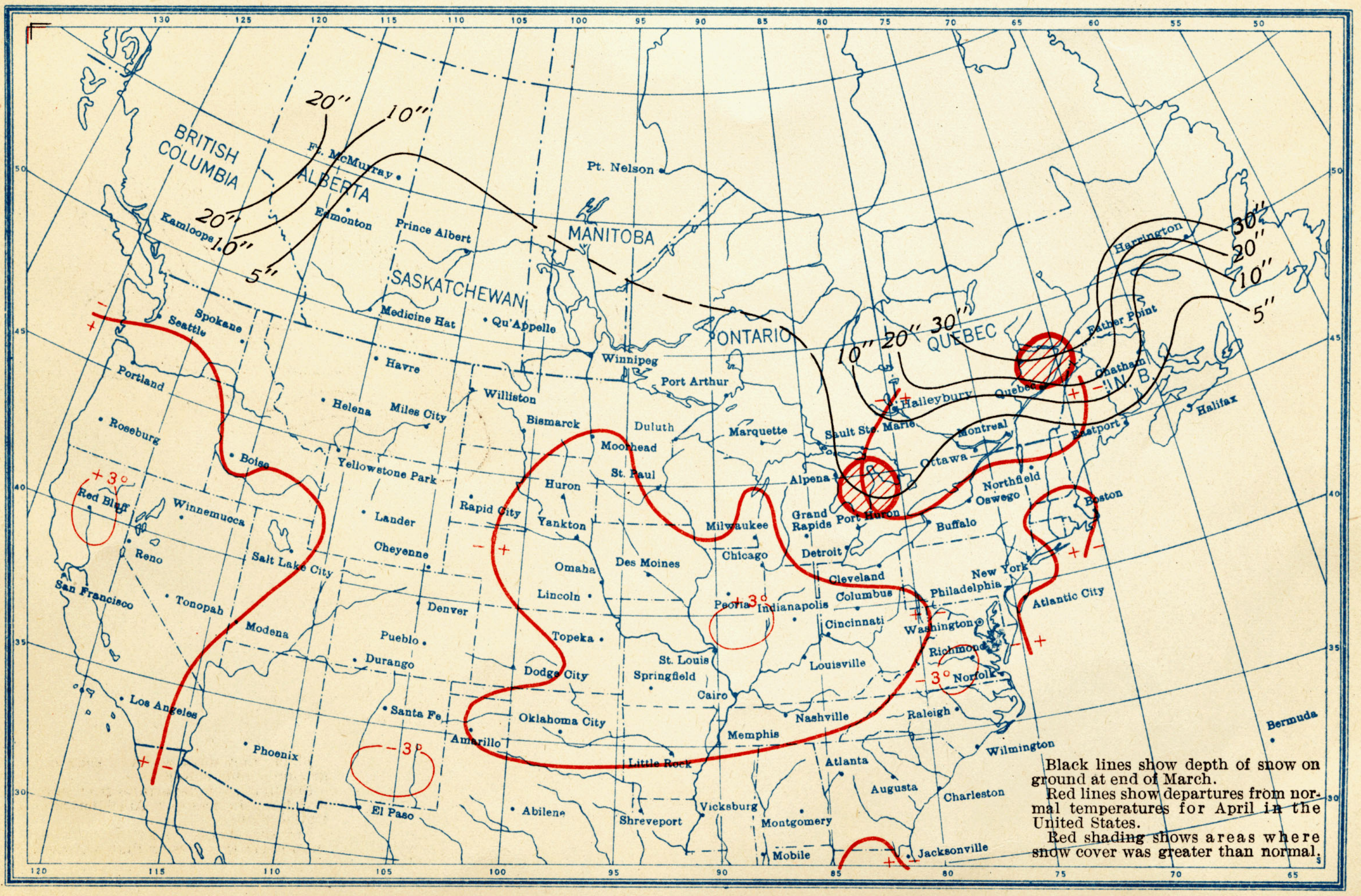
Snowfall Over Southern Canada at End of March and Temperature Departures in the United States for April, 1922



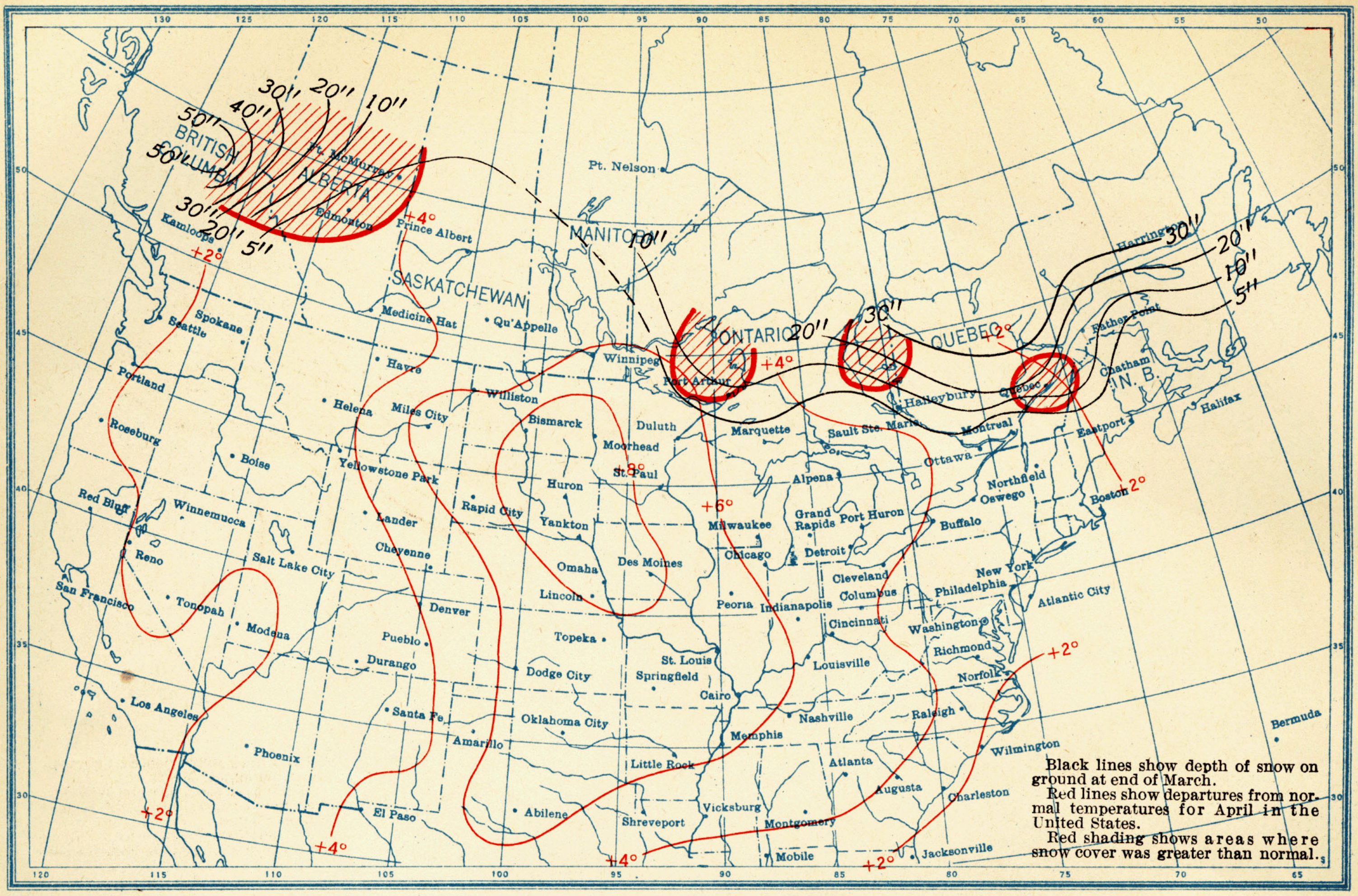
Snowfall Over Southern Canada at End of March and Temperature Departures in the United States for April, 1923



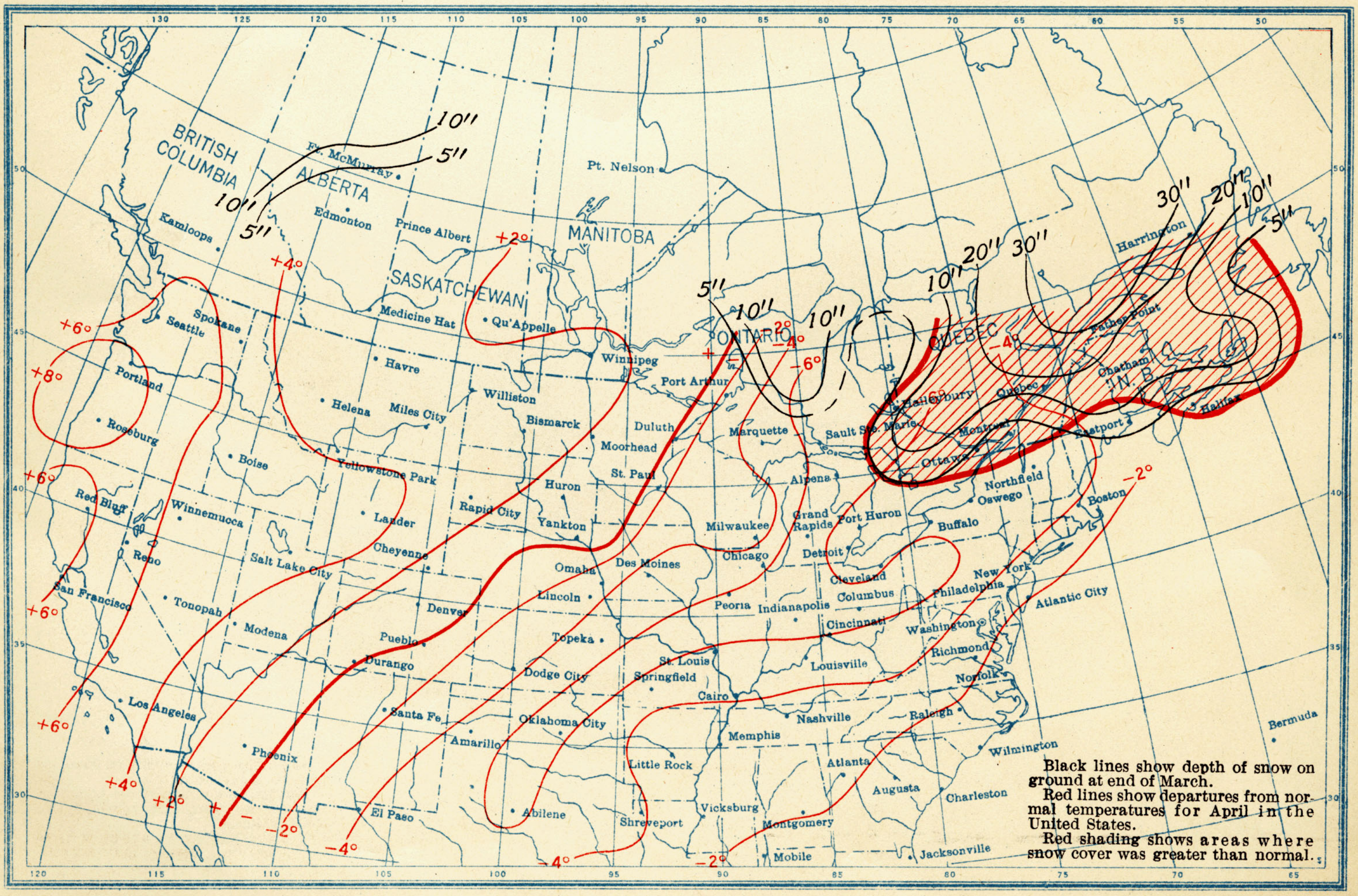
Snowfall Over Southern Canada at End of March and Temperature Departures in the United States for April, 1924



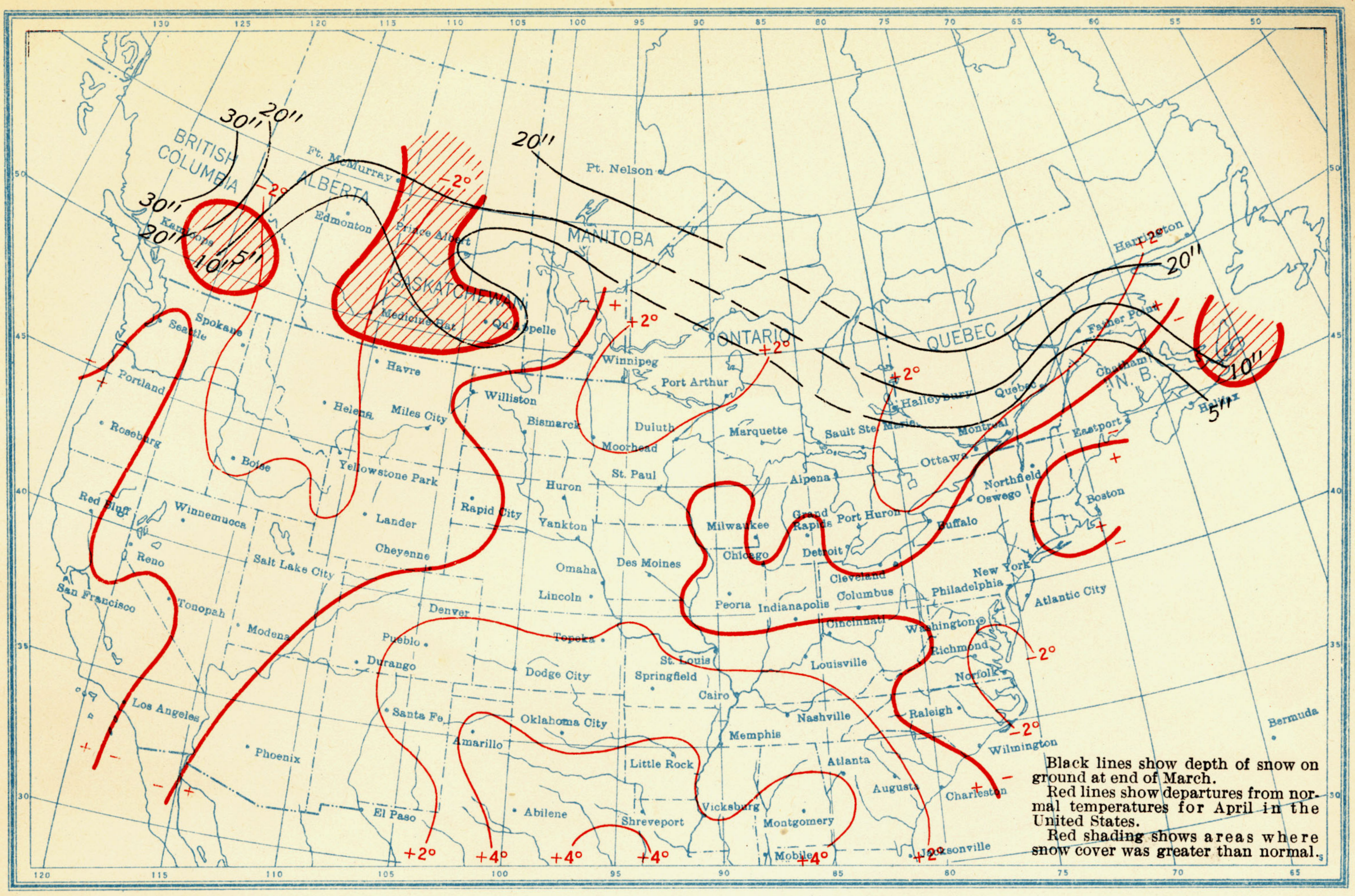
Snowfall Over Southern Canada at End of March and Temperature Departures in the United States for April, 1925



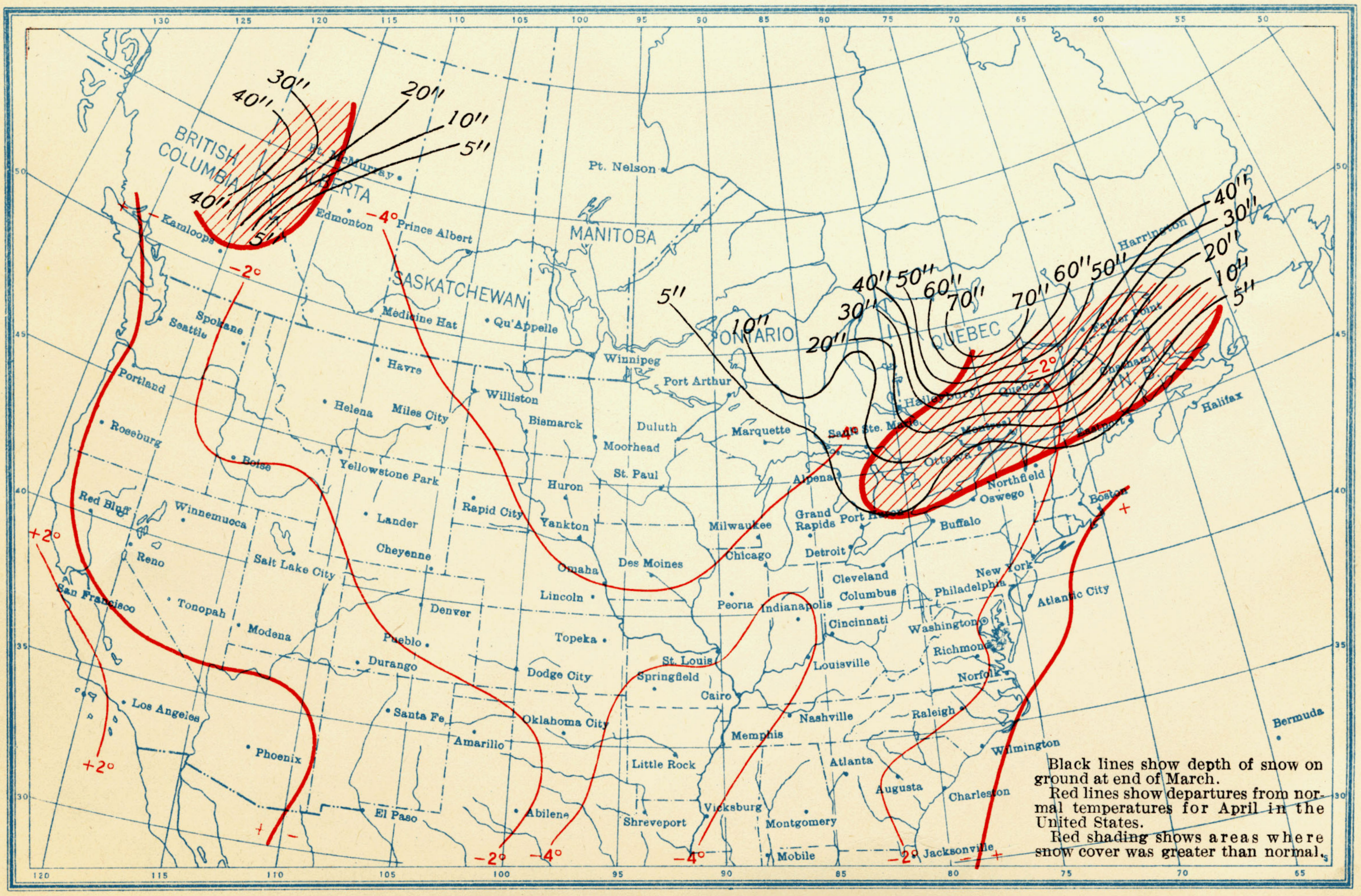
Snowfall Over Southern Canada at End of March and Temperature Departures in the United States for April, 1926



Snowfall Over Southern Canada at End of March and Temperature Departures in the United States for April, 1927



Snowfall Over Southern Canada at End of March and Temperature Departures in the United States for April, 1928



THE LAKE REGION

Years with April temperatures 1° or more below normal in the Lake Region, as represented by 10 well-distributed stations, were 1917 (−2.4°), 1920 (−3.7°), 1923 (−1.4°), 1926 (−5.6°) and 1928 (−2.4°).

1917.—At the end of March, a moderate snow blanket extended from the lower St. Lawrence Valley westward to the east of Lake Superior and to the North of Lake Huron, also over Saskatchewan and northern Manitoba. This condition was followed by April temperatures 2.4° below normal in the Lake Region.

1920.—Snowfall was above normal over Manitoba, central and southern Saskatchewan, and central and northern Alberta, but was considerably below normal over eastern Canada as a whole. The temperature departure for the Lake region was 3.7° below normal.

1923.—This year showed the deepest and most extensive snow cover at the end of March of any year in the period for which data are available. The region of above-normal depth extended from the Canadian Maritime Provinces westward over Quebec, Ontario, central and southern Manitoba, and Saskatchewan. Temperatures in the Lake region during April were 1.4° below normal.

1926.—Snow cover at the end of March was greater than the average in the St. Lawrence Valley, southeastern Ontario, and the Canadian Maritime Provinces. In the Lake region temperatures averaged 5.6° below normal.

1928.—The year 1928 was quite similar to that of 1926, so far as snow cover is concerned, and the temperatures in the Lake region averaged 2.4° below normal.

Of the five Aprils, with below-normal temperatures in the Lake region, three were preceded by above-normal snow cover at the end of March in Saskatchewan and Manitoba.

The years in which April temperatures were 1° or more above normal were 1921 (+7.0), 1922 (+1.5°), 1925 (+4.3°), and 1927 (+1.1°).

1921.—Snow cover was less than normal at the end of March over central and eastern Canada, being much below in the St. Lawrence Valley and in Ontario from Port Arthur eastward to Cochrane and Haileybury. The April temperature departure in the Lake region was +7.0°.

1922.—Snowfall was below normal in the St. Lawrence Valley, western Ontario, and southeastern Manitoba, being followed by a temperature departure of +1.5° in the Lake region.

1925.—Snow cover was below normal in the St. Lawrence Valley, except Quebec, in eastern Ontario, except at Cochrane, and in Saskatchewan and Manitoba, being followed by April temperatures 4.3° above normal in the Lake region.

1927.—Snow cover was below normal over Canada, except in Saskatchewan and at Kamloops and Sydney, being followed by an April temperature departure of +1.1° in the Lake region.

In all four of these warm Aprils in the Lake region, a snow cover was below normal in the St. Lawrence Valley.

We have now considered April temperatures in two areas, namely, the North Atlantic States and the Lake region, as associated with snow cover over Canada at the end of March. Let us now consider a broader territory, comprising the northeastern Rocky Mountain region, the Plains States, the Ohio, and middle and upper Mississippi Valleys, the Lake region, and the North Atlantic States. Districts 1, 3, 4, 5, and 7. (See Chart No. 1.) The most consistently cold Aprils were in order of degree of coldness, 1920 (−4.0°), 1928 (−2.4°), 1917 (−1.7°), and 1918 (−1.5°), and the most consistently warm ones in the order of warmness were 1925 (+5.2°), 1921 (+3.8°), 1922 (+1.5°), and 1927 (+1.3°).

1920.—Snowfall at the end of March was above normal in Manitoba, Saskatchewan, and part of Alberta, and below normal elsewhere in Canada, being much below over Ontario and the St. Lawrence Valley.

1928.—Snow cover was above normal in the St. Lawrence Valley, New Brunswick, and British Columbia, and below normal elsewhere in Canada.

1917.—Snowfall was above normal in the lower St. Lawrence Valley, northern Ontario, Saskatchewan, and northern Manitoba, and below normal over southeastern Manitoba and southeastern Ontario.

1918.—Snow cover over all of Canada was below normal except at Barkerville, Chatham, Halifax, and Fort McMurray.

Two of the four cold Aprils had above-normal snow cover over Saskatchewan and northern Manitoba, but no systematic relation is apparent.

1925.—Below-normal snow cover prevailed at the end of March over Saskatchewan, Manitoba, and southern Ontario, and above-normal cover over British Columbia, northern Alberta, part of northern Ontario, and at Quebec.

1921.—Snow cover was below normal over all Canada except northeastern Saskatchewan and northern Manitoba, being much below over Ontario and the St. Lawrence Valley.

1927.—Snow cover was below normal over Manitoba, northeastern Saskatchewan, Ontario, the St. Lawrence Valley, and the Canadian Maritime Provinces, and above normal in British Columbia, southern and western Saskatchewan, part of Alberta, and at Sydney.

1922.—Snow cover was mostly below normal except in portions of Saskatchewan and Manitoba and northeastern Ontario.

These four cases of warm Aprils seem quite consistent as to antecedent snow conditions, as cover over most all of Canada was below normal at the end of March in each case.

However, the author is forced to the conclusion that considering all available data from stations in southern Canada, there is little if any consistent relationship between snow cover at the end of March in southern Canada and April temperatures in our States immediately south of the Canadian border line.

It is to be regretted that depth-of-snow observations are not available from higher-latitude stations in central and eastern Canada, in which case, no doubt, more satisfactory results could have been obtained.

It seems fair to suppose that the temperatures in our northern border States are determined by several factors, at least; one of which is snow cover over Canada and while the results obtained in this study indicate quite clearly that the snow cover over southern Canada is not the main factor, nevertheless the snow cover undoubtedly has its influence.

Similar comparisons have been made between snow cover at the end of February with temperatures in northern States in March, but the results are as disappointing as those for April.

TABLE 1.—*Snow on ground at end of March*

	Dawson	Barkerville	Fort McMurray	Edmonton	Battleford	Prince Albert	Le Pas	Calgary	Medicine Hat	Swift Current	Quappelle	Minnedosa	Winnipeg	Port Nelson	Port Arthur	White River
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1916	----	----	T.	----	----	4.0	9.0	0	----	0	4.0	4.0	4.0	81.0	14.0	*18.0*
1917	----	----	----	2.0	*5.0*	8.0	9.0	0	*0*	0	8.0	T.	T.	----	5.0	30.0
1918	----	30.0	10.0	T.	*T.*	*0*	0	0	0	*0*	*0*	0	*0*	9.5	0	12.0
1919	14.0	22.0	12.0	0	*2.0*	4.0	3.0	*0*	0	0	3.0	5.0	T.	20.0	*T.*	T.
1920	22.0	3.5	5.5	6.5	8.0	6.0	*10.0*	1.5	T.	*3.0*	6.0	9.0	3.0	40.0	0	0–12
1921	22.0	25.0	6.0	0	*4.0*	10.0	10.0	0	0	*0*	0	2.0	T.	----	0.5	8.0
1922	----	26.0	16.5	----	*10.0*	11.0	7.3	----	----	----	10.0	2.0	*2.0*	12.0	*T.*	12.0
1923	42.0	44.0	11.5	T.	*T.*	T.	8.0	0	T.	7	16.0	22.0	9.0	2.5	15.0	38.0
1924	21.0	26.0	8.5	2.0	*1.0*	*1.0*	2.0	*T.*	0	*0*	0	T.	*T.*	----	2.2	T.
1925	30.0	55.0	5.0	4.0	*1.0*	T.	1.0	----	----	----	0	T.	T.	----	14.0	7.0
1926	14.0		----	T.	*T.*	0	T.	*T.*	*T.*	T.	T.	T.	T.	----	2.0	12.0
1927	13.0	30.0	13.5	2.0	6.0	2.0	2.0	----	*3.0*	*4.0*	6.0	2.0	*2.0*	26.0	T.	0–15
1928	29.0	42.0	T.	0	*1.5*	3.0	*3.0*	*T.*	0	*T.*	*T.*	T.	0	----	4.0	14.0
Average	23.0	27.6	8.0	1.5	3.2	3.8	5.0	0.2	0.3	1.3	4.1	3.5	1.5	27.3	4.4	13.5

NOTE.—Figures in italics are interpolated.

TABLE 1.—*Snow on ground at end of March*—Continued

	Cochrane	Haileybury	Stonecliffe	Parry Sound	Southampton	Ottawa	Montreal	Quebec	Father Point	Chatham	Harrington	Sydney	Halifax	Anticosti
	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1916	36.0	24.0	18.0	*12.0*	----	7.0	T.	8.0	24.0	T.	----	T.	2.0	----
1917	*32.0*	28.0	6.0	T.	0.5	T.	T.	20.0	24.0	6.0	4.0	0	T.	23.0
1918	*12.0*	----	6.0	T.	1.0	T.	3.0	18.0	*19.0*	*10.0*	42.0	T.	3.5	16.0
1919	*5.0*	15.0	6.0	*3.0*	*0*	2.5	13.0	8.0	30.0	9.0	3.0	0	T.	6.0
1920	*T.*	T.	4.0	*3.0*	2.0	0	T.	1.0	10.0	4.0	----	0	0	42.0
1921	*5.0*	T.	*T.*	*T.*	*0*	0	0	1.2	*6.0*	0	*10.0*	0	T.	12.0
1922	*22.0*	20.0	*1.0*	T.	4.0	1.0	3.0	1.8	10.0	0	----	6.0	4.0	----
1923	*40.0*	----	*20.0*	24.0	15.0	14.0	17.4	44.0	54.0	22.0	----	34.0	10.0	38.0
1924	*5.0*	----	*5.0*	6.0	5.0	1.0	1.0	28.6	*21.0*	8.0	36.0	4.0	T.	7.0
1925	*28.0*	----	*8.0*	T.	*T.*	*T.*	T.	20.0	*19.0*	T.	----	0	*0*	19.0
1926	0	----	*11.0*	10.0	3.0	*5.0*	6.0	22.0	*30.0*	12.0	----	12.0	5.0	32.0
1927	*8.0*	----	*1.0*	T.	T.	*1.0*	*2.0*	3.0	*9.0*	4.0	----	16.0	T.	18.0
1928	10.0	----	*12.0*	12.0	6.0	5.0	15.0	48.0	*30.0*	8.0	----	1.0	T.	----
Average	15.6	14.5	7.5	5.4	3.0	2.8	4.3	17.2	22.0	6.4	19.0	5.6	1.9	21.3

FLIGHT OF RS–1, SAN ANTONIO, TEX., TO SCOTT FIELD, ILL.[1]

By WILLIAM E. KEPNER, Captain, Air Corps, U. S. A.

When over Memphis we were still unable to get in touch with Scott Field. The sky to the west had been gradually thickening up. The sun was still shining where the ship was. At 1:20 p. m. there appeared a number of small rains traveling rapidly eastward across our path several miles ahead. The ship was headed about and we circled one of these with very little effect on the ship's stability. The ship was slowly circling to maneuver between several of these shower areas, when there appeared a specially favorable opening to the west. It looked as though there was a distinct wind shift line to the north and it was traveling nearly east. It was decided to fly into the apparently clear area to the west of Memphis and thus be well in rear of the squalls to the north.

Just as the ship was well on her course to the west and appeared to be running safely around the rain area, a deadly looking line squall, already perfectly developed, came racing across the sky from the northwest on a path that bid fair to interrupt the ship. To turn the ship either way was to lose time. The ship was allowed to drift slightly toward the rain on our left and the motors turned up to where the air speed was 53 miles per hour. However, the ship was being caught in the storm on our left. It was dragged rapidly in toward the center of the small disturbance and shortly afterward began to pitch and toss violently with an increasing tendency to rise in spite of even a 25° angle of descent. There was a sensation of being dragged backward and upward, with the ship out of control. There was nothing left but to run all motors at full speed. The ship was momentarily headed to the right and at an air speed of 65 miles per hour began to leave the rain squall. We were just out with a sickening plunge downward, when the line squall in the northwest appeared to be practically on top of us. This "line" was a coal-black body about 1,000 feet above the ground, with a bluish green color running underneath and all the way to the ground. From the black line great chunks of cloud were frequently thrown off, with an appearance of being immediately torn to pieces in the disturbed air just beneath. The airspeed indicator began to jump from gusts that we began at once to feel on the ship's nose. The ship would shudder as though it had bumped into something. The ship was turned as quickly as possible with such high speed, to the left and around the rear of the storm we had just left. We barely missed the northwest line squall and were in fair weather, heading southeast with the motors again throttled to cruising speed. There was a line of squalls bearing to the south, west, and northeast.

An inspection of the ship disclosed that the rigid nose had given way just where the longitudinals meet and make the nose tip. The solid cone plate, to which all girders were bolted, had broken all around and each longitudinal end was swinging free. Only two longitudinals beside the main keel structure remained solidly in place. The entire top of the nose had given way at the tip. A couple of the spacer girders that make a ring about half way back were crushed, and the nose cover was torn somewhat. The longitudinals were pushed back into place and the ends laced together with cable in an effort to approximate a new nose tip. The repair seemed satisfactory under the circumstances.

It was then 2:10 p. m. and we were traveling east. The squalls appeared to make a line across the north, west, and south. I planned to fly east and, if possible, land near Nashville, Tenn., refuel, and then outrun the storm to Langley Field, Va.

At 2:30 p. m. another line appeared across the east, and we seemed to be trapped completely. The circle of storms was about 30 miles in diameter. This was rapidly becoming less and less. When the border appeared about 5 miles away in all directions, there was a small break to the south. It was apparently our only chance, and I decided to take it. We could not afford to be caught in the center of all those approaching storms.

We moved cautiously into the opening southward. There was rain to our left and another line squall, not so well developed, on our right. With a crippled nose, it was decided to push the ship only so far as was absolutely necessary. The ship was alternately dragged first to the left, then to the right, as we would be near first one storm, then the other. When it appeared we were successfully getting through, there was an icy draft through the control car from our right, and the ship was running directly sideways to the left at an increasing

[1] Extract from official report made to Chief of Air Corps, Washington, D. C., October 18, 1928.